US011202729B2

(12) **United States Patent**
Desaulniers

(10) **Patent No.: US 11,202,729 B2**
(45) **Date of Patent: Dec. 21, 2021**

(54) **PATIENT SUPPORT APPARATUS USER INTERFACES**

(71) Applicant: **Stryker Corporation**, Kalamazoo, MI (US)

(72) Inventor: **Annie Desaulniers**, Bothell, WA (US)

(73) Assignee: **Stryker Corporation**, Kalamazoo, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 784 days.

(21) Appl. No.: **16/020,003**

(22) Filed: **Jun. 27, 2018**

(65) **Prior Publication Data**

US 2018/0369037 A1 Dec. 27, 2018

Related U.S. Application Data

(60) Provisional application No. 62/525,373, filed on Jun. 27, 2017.

(51) **Int. Cl.**

A61G 7/018 (2006.01)
A61G 7/012 (2006.01)

(Continued)

(52) **U.S. Cl.**

CPC ***A61G 7/018*** (2013.01); ***A61G 7/012*** (2013.01); ***A61G 13/02*** (2013.01); ***A61G 13/06*** (2013.01);

(Continued)

(58) **Field of Classification Search**

CPC A61G 7/002; A61G 7/012; A61G 7/018; A61G 13/02; A61G 13/06

(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,113,214	A	5/1992	Nagata et al.
5,276,432	A	1/1994	Travis

(Continued)

FOREIGN PATENT DOCUMENTS

CN	101789230	A	7/2010
DE	19505162	C1	3/1996

(Continued)

OTHER PUBLICATIONS

Umano Medical Inc., “The Ook Snow Bed Webpages and Video”, https://www.umanomedical.com/en-us/beds/ook-snow?showall=1, 2019, 6 pages.

(Continued)

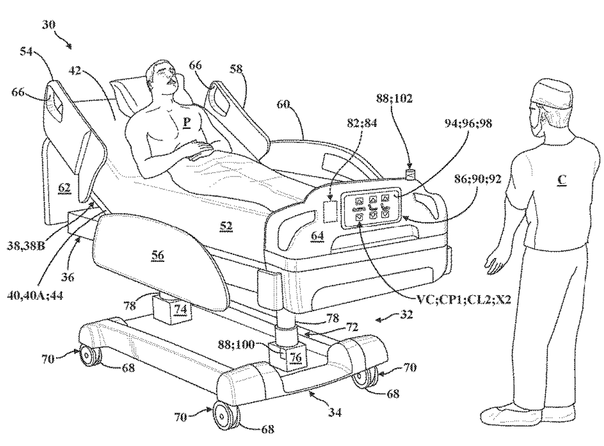
Primary Examiner — Robert G Santos

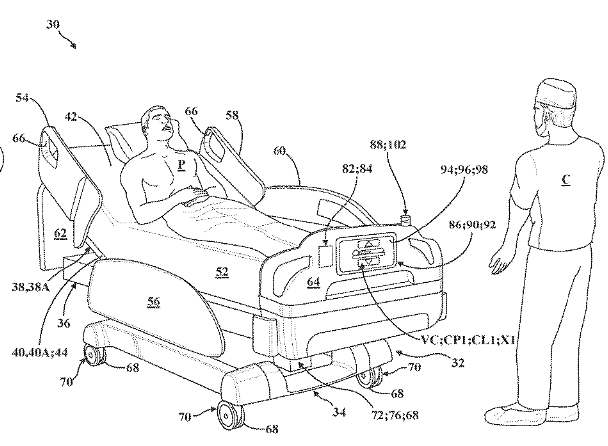
(74) *Attorney, Agent, or Firm* — Howard & Howard Attorneys PLLC

(57) **ABSTRACT**

A patient support apparatus comprising a patient support deck operatively attached to a base with a lift mechanism interposed between the base and the patient support deck to move the patient support deck between first and second vertical configurations relative to the base. A user interface configured to operate the patient support apparatus is provided and comprises a screen configured to display visual content in first and second content layouts. The screen is coupled to the patient support deck for concurrent movement between the vertical configurations A controller disposed in communication with the screen and the lift mechanism is configured to display the visual content in the first content layout when the patient support deck is in the first vertical configuration, and further configured to display the visual content in the second interface layout when the patient support deck is in the second vertical configuration.

6 Claims, 7 Drawing Sheets





(51) **Int. Cl.**
A61G 13/02 (2006.01)
A61G 13/06 (2006.01)
G06F 3/0482 (2013.01)

(52) **U.S. Cl.**
CPC ***G06F 3/0482*** (2013.01); *A61G 2203/16* (2013.01); *A61G 2203/20* (2013.01); *A61G 2203/40* (2013.01)

(58) **Field of Classification Search**
USPC 5/611, 600, 11
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,434,621 A 7/1995 Yu
5,640,953 A 6/1997 Bishop et al.
5,645,667 A 7/1997 Kusen
5,664,270 A 9/1997 Bell et al.
6,320,510 B2 11/2001 Menkedick et al.
6,340,977 B1 1/2002 Lui et al.
6,351,678 B1 2/2002 Borders
6,362,725 B1 3/2002 Ulrich et al.
6,396,224 B1 5/2002 Luff et al.
6,560,492 B2 5/2003 Borders
6,876,303 B2 4/2005 Reeder et al.
6,948,592 B2 9/2005 Kavounas
7,017,208 B2 3/2006 Weismiller et al.
7,038,588 B2 5/2006 Boone et al.
7,154,397 B2 12/2006 Zerhusen et al.
7,296,312 B2 11/2007 Menkedick et al.
7,319,386 B2 1/2008 Collins, Jr. et al.
7,336,187 B2 2/2008 Hubbard, Jr. et al.
7,389,552 B1 6/2008 Reed et al.
7,443,302 B2 10/2008 Reeder et al.
7,557,718 B2 7/2009 Petrosenko et al.
7,570,152 B2 8/2009 Smith et al.
7,690,059 B2 4/2010 Lemire et al.
7,702,481 B2 4/2010 Dionne et al.
7,747,644 B1 6/2010 Reihl et al.
7,888,901 B2 2/2011 Larson et al.
7,895,519 B1 2/2011 Allegrezza et al.
7,911,349 B2 3/2011 Zerhusen et al.
7,945,452 B2 5/2011 Fathallah et al.
7,973,666 B2 7/2011 Petrosenko et al.
8,069,157 B2 11/2011 Jam
8,117,701 B2 2/2012 Bobey et al.
8,121,856 B2 2/2012 Huster et al.
8,143,846 B2 3/2012 Herman et al.
8,165,908 B2 4/2012 Bolle et al.
8,209,608 B1 6/2012 Linyard et al.
8,266,742 B2 9/2012 Andrienko
8,308,237 B2 11/2012 Kunou
8,319,633 B2 11/2012 Becker et al.
8,334,779 B2 12/2012 Zerhusen et al.
8,410,943 B2 4/2013 Metz et al.
8,413,271 B2 4/2013 Blanchard et al.
8,413,273 B2 * 4/2013 Hornbach A61G 7/0524
5/611
8,432,287 B2 4/2013 O'Keefe et al.
8,442,738 B2 5/2013 Patmore
8,442,843 B2 5/2013 Kneuer et al.
8,544,126 B2 10/2013 Elliott et al.
8,552,880 B2 10/2013 Kopp et al.
8,566,118 B2 10/2013 Kneuer et al.
8,572,778 B2 11/2013 Newkirk et al.
8,606,600 B2 12/2013 Kneuer et al.
8,641,301 B2 2/2014 Yang et al.
8,650,682 B2 2/2014 Herman
8,674,839 B2 3/2014 Zerhusen et al.
8,689,376 B2 4/2014 Becker et al.
8,706,527 B2 4/2014 Kneuer et al.
8,716,941 B2 5/2014 Kim
8,752,220 B2 6/2014 Soderberg et al.
8,756,078 B2 6/2014 Collins, Jr. et al.
8,789,102 B2 7/2014 Pickelsimer et al.
8,789,222 B2 7/2014 Blanchard et al.
8,844,078 B2 * 9/2014 Hornbach A61G 7/0514
5/611
8,866,598 B2 10/2014 Collins, Jr. et al.
8,868,542 B2 10/2014 Kimball et al.
8,896,524 B2 11/2014 Birnbaum et al.
8,923,994 B2 12/2014 Laikari et al.
8,926,535 B2 1/2015 Rawls-Meehan
8,984,685 B2 3/2015 Robertson et al.
9,001,038 B2 4/2015 Kasahara
9,032,510 B2 5/2015 Sampathkumaran et al.
9,050,031 B2 6/2015 Collins, Jr. et al.
9,088,282 B2 7/2015 Holenarsipur et al.
9,104,789 B2 8/2015 Gross et al.
9,126,571 B2 9/2015 Lemire et al.
9,138,173 B2 9/2015 Penninger et al.
9,186,113 B2 11/2015 Harper et al.
9,204,823 B2 12/2015 Derenne et al.
9,228,885 B2 1/2016 Zerhusen et al.
9,230,421 B2 1/2016 Reeder et al.
9,233,038 B2 1/2016 Gibson et al.
9,259,369 B2 2/2016 Derenne et al.
9,262,876 B2 2/2016 Wood et al.
9,320,664 B2 4/2016 Newkirk et al.
9,336,672 B2 5/2016 Collins, Jr. et al.
9,342,677 B2 5/2016 Ali et al.
9,358,168 B2 6/2016 Williamson et al.
9,424,699 B2 8/2016 Kusens et al.
9,456,938 B2 10/2016 Blickensderfer et al.
9,466,163 B2 10/2016 Kusens et al.
9,480,435 B2 11/2016 Olsen
9,492,341 B2 11/2016 Uster et al.
9,569,591 B2 2/2017 Vanderpohl, III
9,593,833 B2 3/2017 McMannon et al.
9,613,445 B2 4/2017 Gilger et al.
9,618,383 B2 4/2017 Zerhusen et al.
9,691,206 B2 6/2017 Kusens et al.
9,774,991 B2 9/2017 Kusens
9,814,410 B2 11/2017 Kostic et al.
9,838,849 B2 12/2017 Kusens
9,849,051 B2 12/2017 Newkirk et al.
9,858,741 B2 1/2018 Kusens et al.
9,861,321 B2 1/2018 Collins, Jr. et al.
9,892,310 B2 2/2018 Kusens et al.
9,892,311 B2 2/2018 Kusens et al.
9,916,649 B1 3/2018 Kusens
9,934,427 B2 4/2018 Derenne et al.
9,940,810 B2 4/2018 Derenne et al.
9,984,521 B1 5/2018 Kusens et al.
9,998,857 B2 6/2018 Kusens
10,052,249 B2 8/2018 Elliott et al.
10,176,608 B2 1/2019 Gilger et al.
10,363,181 B2 7/2019 Williamson et al.
10,391,008 B2 8/2019 Zerhusen et al.
10,420,688 B2 9/2019 Furman et al.
10,561,552 B2 * 2/2020 Newkirk A61G 7/05
2002/0014951 A1 2/2002 Kramer et al.
2003/0183427 A1 10/2003 Tojo et al.
2004/0083394 A1 4/2004 Brebner et al.
2006/0077186 A1 4/2006 Park et al.
2006/0101581 A1 5/2006 Blanchard et al.
2006/0102392 A1 5/2006 Johnson et al.
2007/0163045 A1 7/2007 Becker et al.
2007/0219950 A1 9/2007 Crawford
2008/0141459 A1 6/2008 Hamberg et al.
2008/0172789 A1 7/2008 Elliot et al.
2008/0235872 A1 10/2008 Newkirk et al.
2009/0153370 A1 6/2009 Cooper et al.
2010/0039414 A1 2/2010 Bell
2010/0212087 A1 8/2010 Leib et al.
2011/0080421 A1 4/2011 Capener
2011/0162067 A1 6/2011 Shuart et al.
2011/0214234 A1 * 9/2011 Herman A61G 7/0524
5/600
2012/0089419 A1 4/2012 Huster et al.
2012/0124744 A1 * 5/2012 Hornbach A61G 7/012
5/611
2012/0137436 A1 6/2012 Andrienko

(56) **References Cited**

U.S. PATENT DOCUMENTS

2012/0215360 A1 8/2012 Zerhusen et al.
2012/0239173 A1 9/2012 Laikari et al.
2013/0096701 A1 4/2013 Suorajaervi et al.
2013/0138452 A1 5/2013 Cork et al.
2013/0142367 A1 6/2013 Berry et al.
2013/0219622 A1* 8/2013 Hornbach A61G 7/0524 5/611
2013/0238991 A1 9/2013 Jung et al.
2013/0300867 A1 11/2013 Yoder
2013/0318716 A1 12/2013 Vanderpohl, III
2014/0076644 A1 3/2014 Derenne et al.
2014/0137025 A1* 5/2014 Newkirk G16H 40/63 715/771
2014/0259410 A1 9/2014 Zerhusen et al.
2014/0265181 A1 9/2014 Lambarth et al.
2014/0297327 A1 10/2014 Heil et al.
2014/0313700 A1 10/2014 Connell et al.
2014/0342330 A1 11/2014 Freeman et al.
2015/0002393 A1 1/2015 Cohen et al.
2015/0077534 A1 3/2015 Derenne et al.
2015/0109442 A1 4/2015 Derenne et al.
2015/0154002 A1 6/2015 Weinstein et al.
2015/0250669 A1 9/2015 Elliott et al.
2015/0317068 A1 11/2015 Marka et al.
2016/0012218 A1 1/2016 Perna et al.
2016/0022039 A1 1/2016 Paul et al.
2016/0038361 A1 2/2016 Bhimavarapu et al.
2016/0049028 A1 2/2016 Kusens et al.
2016/0050217 A1 2/2016 Mare et al.
2016/0065909 A1 3/2016 Derenne et al.
2016/0140307 A1 5/2016 Brosnan et al.
2016/0180668 A1 6/2016 Kusens et al.
2016/0183864 A1 6/2016 Kusens et al.
2016/0193095 A1 7/2016 Roussy et al.
2016/0199240 A1 7/2016 Newkirk et al.
2016/0247342 A1 8/2016 Kusens et al.
2016/0296396 A1 10/2016 Kolar et al.
2016/0338891 A1 11/2016 Agdeppa et al.
2016/0366327 A1 12/2016 Kusens
2016/0367420 A1 12/2016 Zerhusen et al.
2016/0371786 A1 12/2016 Kusens et al.
2017/0027787 A1 2/2017 Huster et al.
2017/0055113 A1 2/2017 Kusens
2017/0076526 A1 3/2017 Kusens et al.
2017/0094477 A1 3/2017 Kusens et al.
2017/0097800 A1 4/2017 Vanderpohl, III
2017/0098048 A1 4/2017 Brosnan et al.
2017/0109770 A1 4/2017 Kusens et al.
2017/0111770 A1 4/2017 Kusens
2017/0116790 A1 4/2017 Kusens et al.
2017/0128296 A1 5/2017 Kostic et al.
2017/0143565 A1 5/2017 Childs et al.
2017/0193177 A1 7/2017 Kusens
2017/0193180 A1 7/2017 Kusens et al.
2017/0193279 A1 7/2017 Kusens et al.
2017/0193772 A1 7/2017 Kusens et al.
2017/0195637 A1 7/2017 Kusens et al.
2017/0213445 A1 7/2017 Kusens
2017/0229009 A1 8/2017 Foster et al.
2017/0281440 A1 10/2017 Puvogel et al.
2017/0352212 A1 12/2017 Kusens et al.
2018/0008052 A1 1/2018 Krickeberg et al.
2018/0017945 A1 1/2018 Sidhu et al.
2018/0040091 A1 2/2018 Kusens
2018/0041864 A1 2/2018 Kusens
2018/0084390 A1 3/2018 Kusens
2018/0096550 A1 4/2018 Kusens et al.
2018/0104123 A1* 4/2018 Newkirk A61G 7/05
2018/0110445 A1 4/2018 Bhimavarapu et al.
2018/0114053 A1 4/2018 Kusens et al.
2018/0137340 A1 5/2018 Kusens et al.
2018/0151010 A1 5/2018 Kusens et al.
2018/0167816 A1 6/2018 Kusens et al.
2018/0189946 A1 7/2018 Kusens et al.
2018/0211464 A1 7/2018 Kusens et al.
2018/0218489 A1 8/2018 Kusens
2018/0303687 A1 10/2018 Moreno et al.
2018/0369035 A1 12/2018 Bhimavarapu et al.
2018/0369037 A1 12/2018 Desaulniers et al.
2018/0369038 A1 12/2018 Bhimavarapu et al.
2018/0369039 A1 12/2018 Bhimavarapu et al.
2018/0374573 A1 12/2018 Bhimavarapu et al.
2018/0374577 A1 12/2018 Bhimavarapu
2019/0262200 A1 8/2019 Murai
2019/0336367 A1 11/2019 Zerhusen et al.
2020/0121528 A1 4/2020 Kaikenger et al.
2020/0188204 A1* 6/2020 Newkirk A61G 7/0524

FOREIGN PATENT DOCUMENTS

EP 0727298 A1 8/1996
EP 0727298 B1 8/1999
EP 2489341 A2 8/2012
EP 2531159 A2 12/2012
EP 2619724 A2 7/2013
EP 2918255 A1 9/2015
JP 2003140631 A 5/2003
KR 20130076922 A 7/2013
WO 2011097569 A2 8/2011
WO 2012040554 A2 3/2012
WO 2014021873 A1 2/2014
WO 2016123595 A1 8/2016
WO 2016200556 A1 12/2016
WO 2017027427 A1 2/2017
WO 2017031111 A1 2/2017
WO 2017124056 A1 7/2017
WO 2018026979 A1 2/2018

OTHER PUBLICATIONS

Youtube, "Umano Medical Ook Snow New Hospital Bed (US Version) Video", Apr. 6, 2015, https://www.youtube.com/watch?v=MEnRNsVFqz0, 1 page.
U.S. Appl. No. 62/783,442, filed Dec. 21, 2018.
U.S. Appl. No. 62/783,445, filed Dec. 21, 2018.
Apple, "Adjust the Brightness on you iPhone, IPad, or IPod Touch", https://support.apple.com/en-us/HT202613, 2018, 2 pages.
Astral Healthcare, "Opthalmology Day Surgery Chair Webpage", Apr. 2018, http://astralhealthcare.com/?product=opthalmology-day-surgery-chair, 6 pages.
Campbell, Mikey, "Apple Expected to Replace Touch ID With Two-Step Facial, Fingerprint Bio-Recognition Tech", Apple Insider, Jan. 21, 2017, http://iphone.appleinsider.com/articles/17/01/21/apple-expected-to-replace-touch-id-with-two-step-facial-fingerprint-bio-recognition-tech, 4 pages.
Doge Medical, "DOC Classic—DOC Surgery Chairs Webpage", 2014, 2 pages, https://web.archive.org/web/20140214203605/http://www.dogemedical.com/pages/en/products/surgery-chairs/doc-classic.php?lang-EN.
English language abstract and machine-assisted English translation for CN 101789230 extracted from espacenet.com database on Aug. 30, 2018, 31 pages.
English language abstract and machine-assisted English translation for JP 2003-140631 extracted from espacenet.com database on Aug. 30, 2018, 19 pages.
English language abstract and machine-assisted English translation for KR 2013-0076922 A extracted from espacenet.com database on Aug. 16, 2018, 8 pages.
English language abstract for DE 195 05 162 C1 extracted from espacenet.com database on Aug. 16, 2018, 1 page.
English language abstract for EP 0 727 298 A1 extracted from espacenet.com database on Aug. 16, 2018, 1 page.
English language abstract for EP 0 727 298 B1 extracted from espacenet.com database on Aug. 16, 2018, 1 page.
Hall, Stephen, "Nest's 3rd Generation Thermostat Gets Some New Views for Its Farsight Feature", 9 to 5 Google, Jun. 14, 2016, https://9to5google.com/2016/06/14/nest-3rd-gen-thermostat-views-farsight/, 4 pages.
Hill-Rom, "Centralia Smart+Bed Brochure" 2017, 11 pages.

(56) **References Cited**

OTHER PUBLICATIONS

Imore, "How to Use Night Shift on your iPhone or iPad", video also found at https://www.imore.com/night-shift, Nov. 1, 2017, 12 pages.
Recliners.LA "Stellar 550 Large Lift Chair Recliner Webpage", Apr. 2018, https://www.recliners.la/products/ultra-comfort-stellar-550-large-lift-chair, 4 pages.
Stryker Medical, "InTouch Critical Care Bed Operations Manual", Aug. 2014, 125 pages.
Stryker, "InTouch Critical Care Bed Model FL27 (2130/2140) Operations Manual—Optional Pendant Control", 2130-009-001 Rev C, Apr. 2008, p. 25.
Supportec-Trade, "Portfolilio Webpage", 2017, https://supportec-trade.nl/en, 2 pages.
U.S. Appl. No. 16/019,973, filed Jun. 27, 2018, 90 pages.
U.S. Appl. No. 16/019,986, filed Jun. 27, 2018, 57 pages.
U.S. Appl. No. 16/020,003, filed Jun. 27, 2018, 37 pages.
U.S. Appl. No. 16/020,052, filed Jun. 27, 2018, 48 pages.
U.S. Appl. No. 16/020,068, filed Jun. 27, 2018, 125 pages.
U.S. Appl. No. 16/020,085, filed Jun. 27, 2018, 67 pages.
U.S. Appl. No. 62/525,359, filed Jun. 27, 2017.
U.S. Appl. No. 62/525,363, filed Jun. 27, 2017.
U.S. Appl. No. 62/525,368, filed Jun. 27, 2017.
U.S. Appl. No. 62/525,373, filed Jun. 27, 2017.
U.S. Appl. No. 62/525,377, filed Jun. 27, 2017.
Youtube, "Memory Seat Escape Video", Nov. 4, 2013, https://www.youtube.com/watch?v=xlghNmAK-7A, 1 page.
Youtube, "Microsoft HoloLens: Partner Spotlight with Stryker Communications Video", Feb. 21, 2017, https://www.youtube.com/watch?v=FTPxUGRGpnA, 3 pages.

* cited by examiner

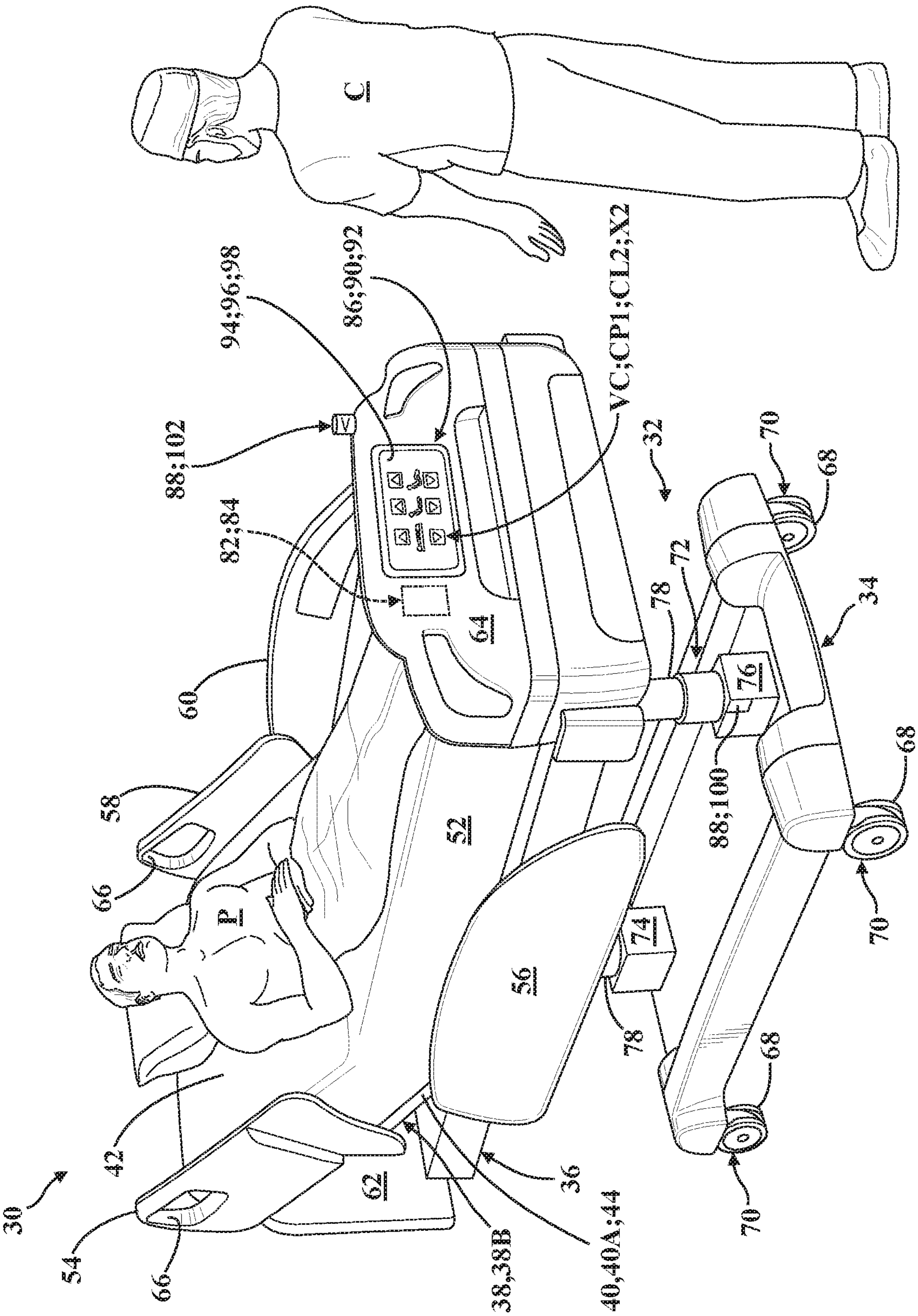

30
54
66
42
62
38,38B
40,40A;44
36
56
74
78
P
52
66
58
60
64
82;84
88;102
94;96;98
86;90;92
VC;CP1;CL2;X2
32
70
68
72
78
76
88;100
34
70
68
70
68
C

FIG. 1A

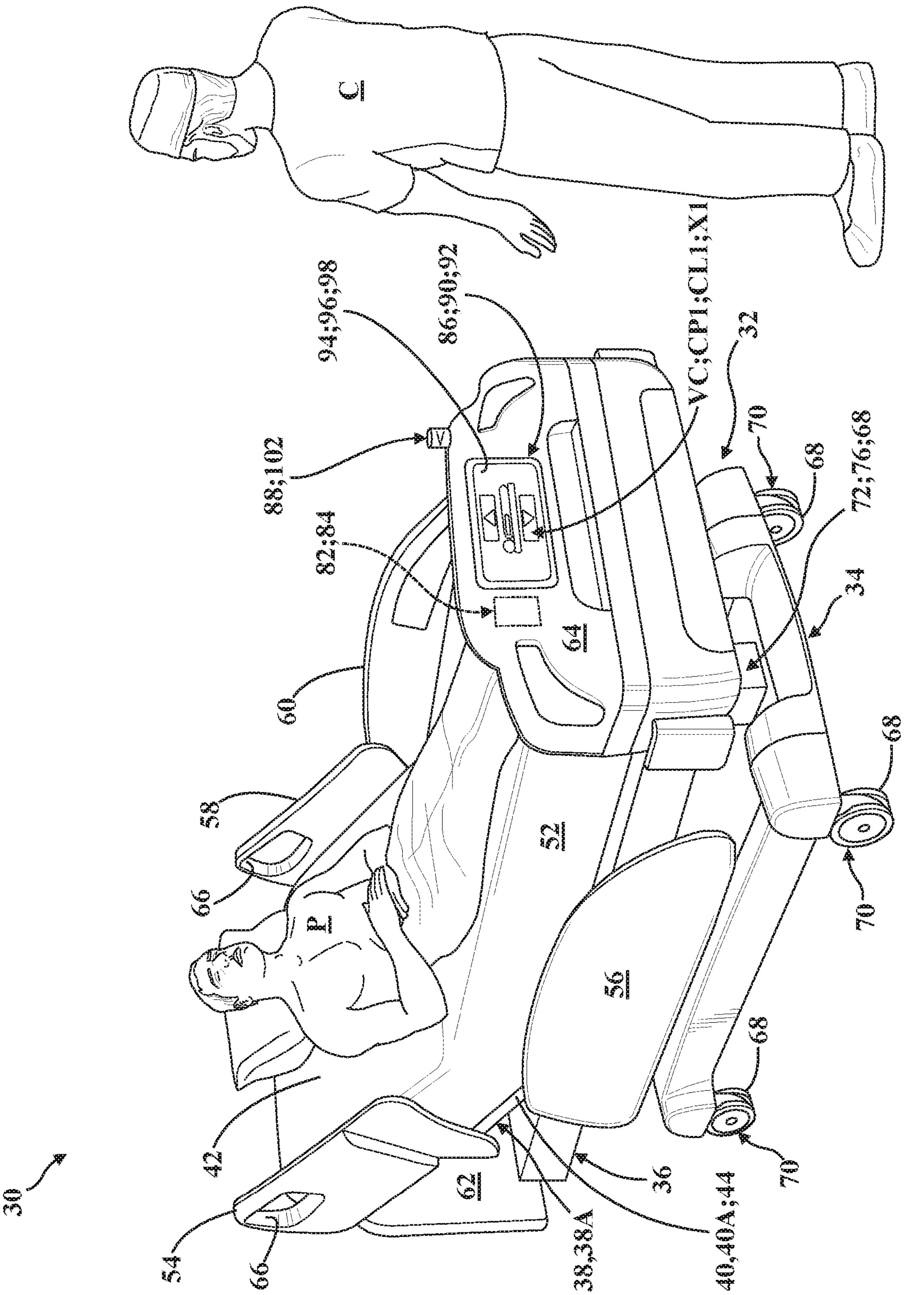

30
32
34
36
38,38A
40,40A;44
42
52
54
56
58
60
62
64
66
68
70
72;76;68
82;84
86;90;92
88;102
94;96;98
VC;CP1;CL1;X1
P
C

FIG. 1B

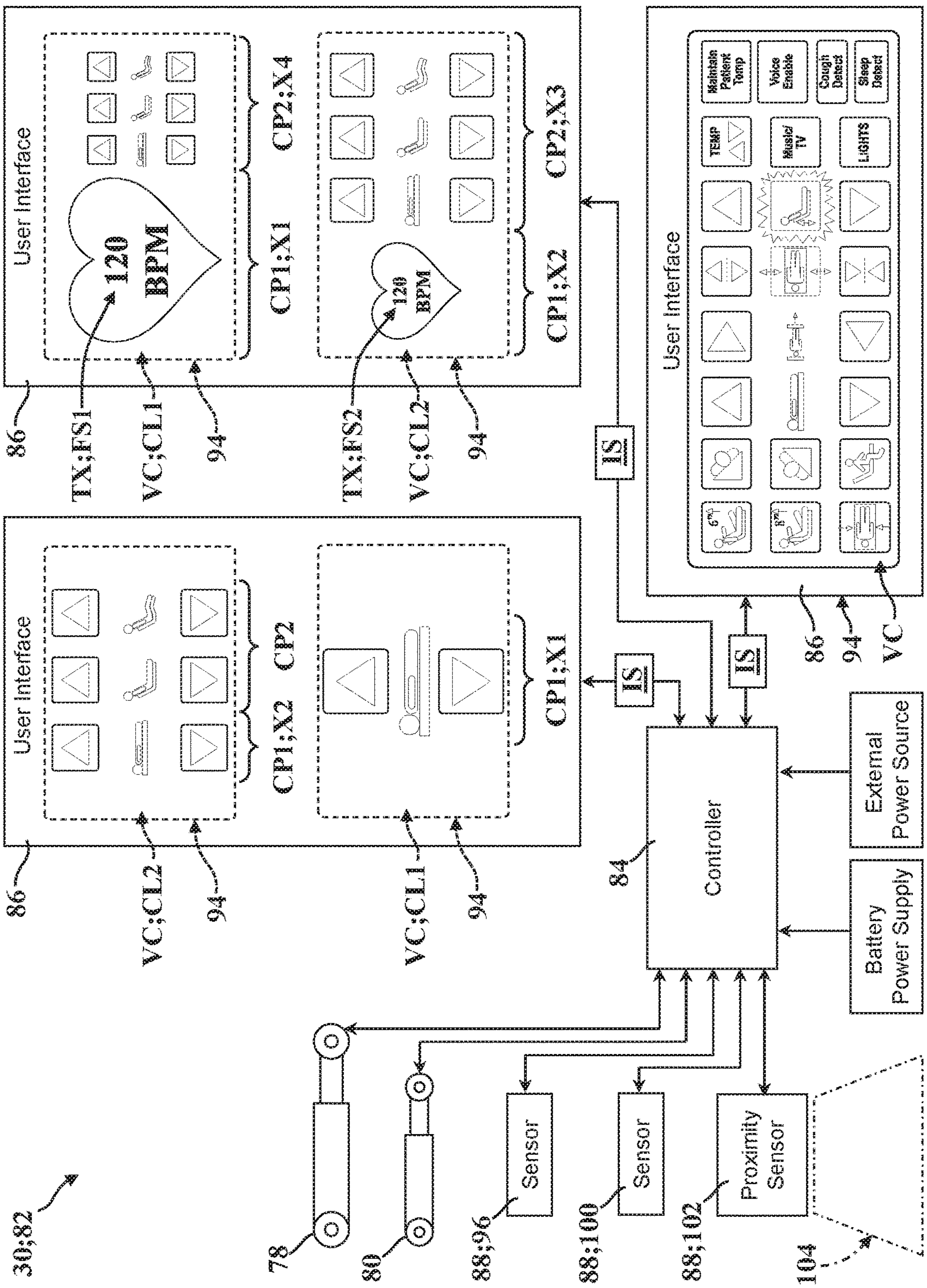

30;82
User Interface
CP1;X2
CP2
CP1;X1
VC;CL2
VC;CL1
86
94
120 BPM
CP1;X1
CP2;X4
CP1;X2
CP2;X3
TX;FS1
TX;FS2
IS
User Interface
Maintain Patient Temp
Voice Enable
Cough Detect
Sleep Detect
TEMP
Music/TV
LIGHTS
VC
Controller
84
External Power Source
Battery Power Supply
78
80
Sensor
88;96
Sensor
88;100
Proximity Sensor
88;102
104

FIG. 2

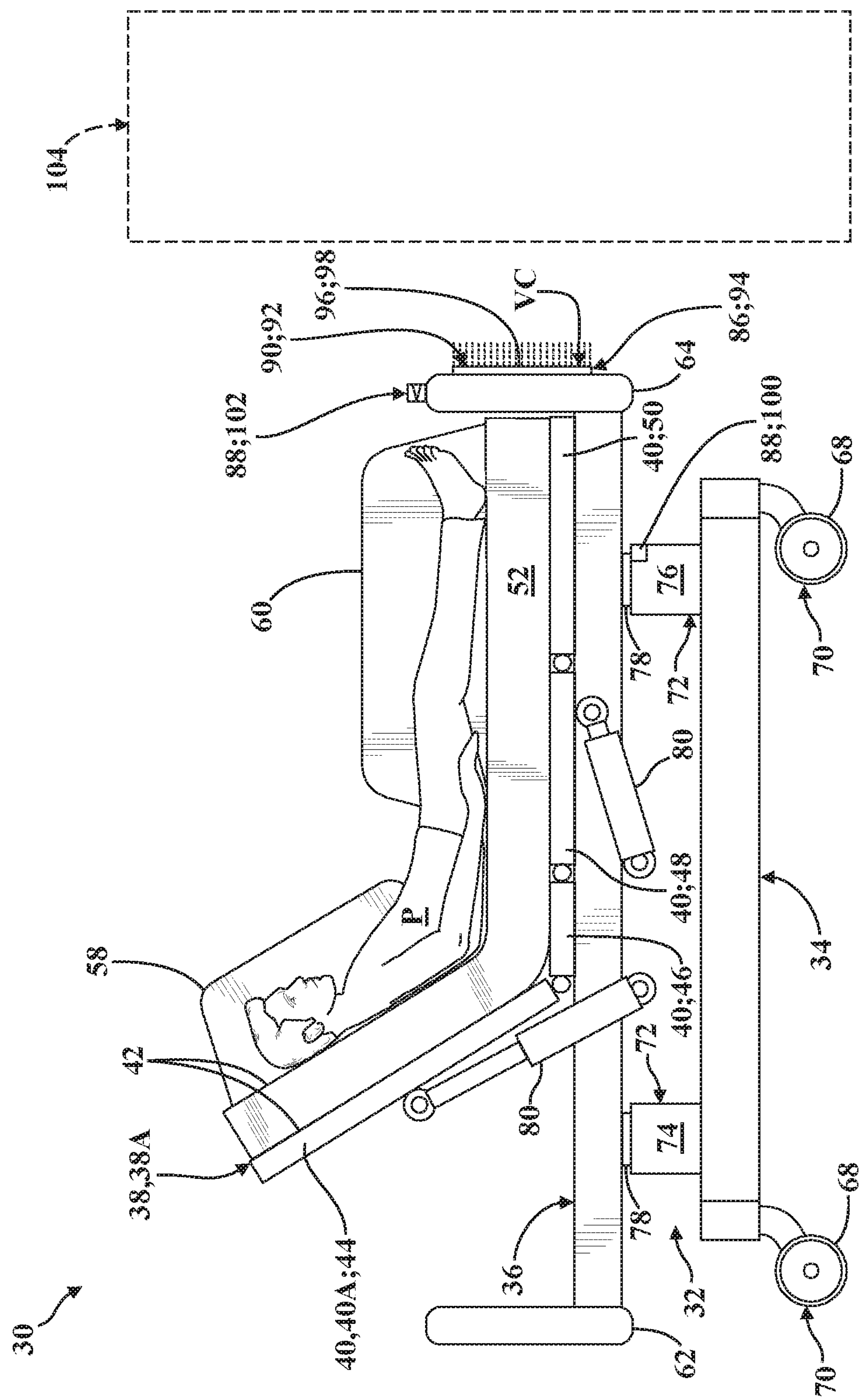

104
96;98
VC
90;92
86;94
88;102
V
64
40;50
88;100
68
60
52
76
78
72
70
80
40;48
P
58
34
42
40;46
72
80
74
38,38A
68
78
40,40A;44
36
32
30
62
70

FIG. 3A

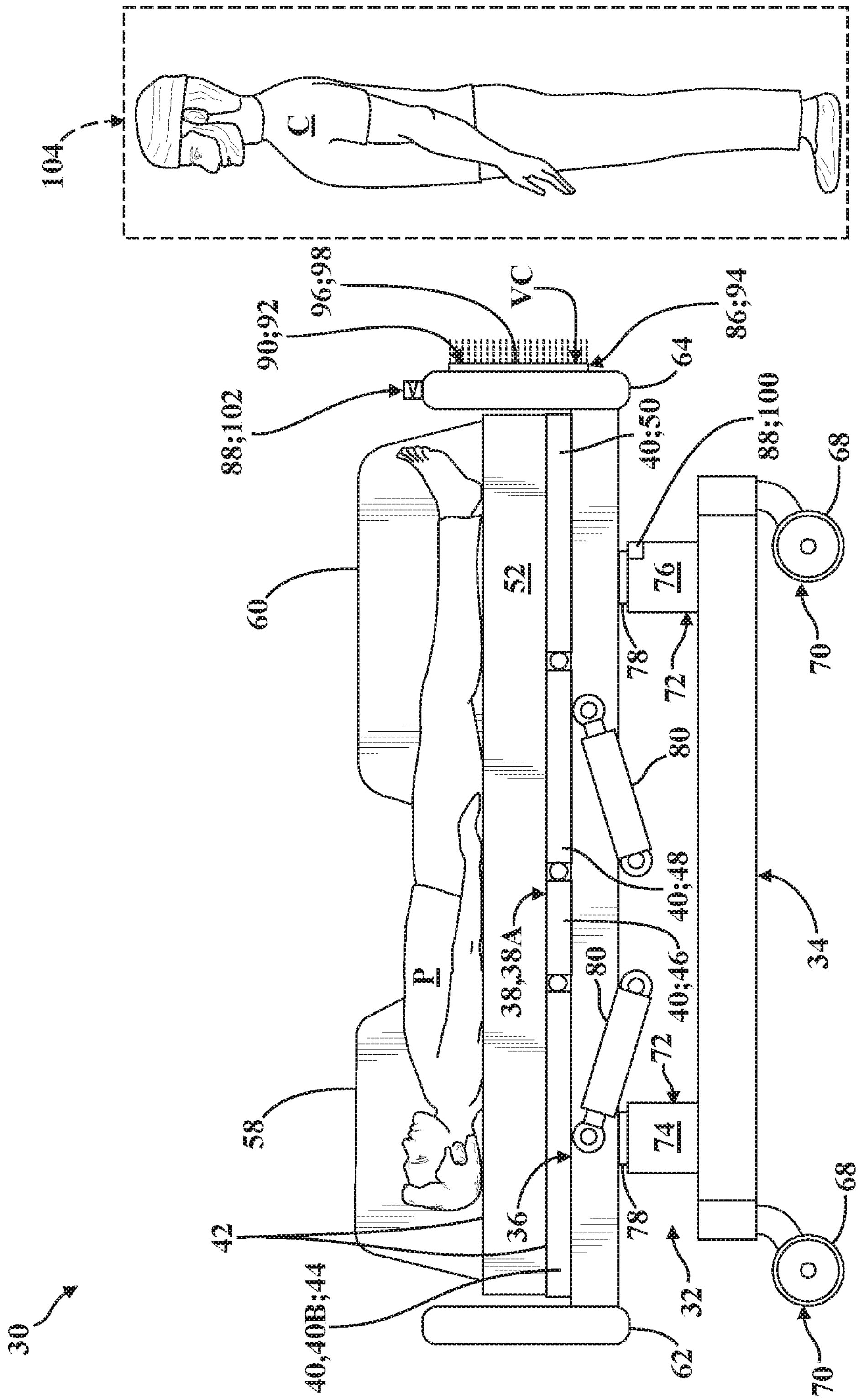

30
104
C
88;102
V
90;92
96;98
VC
86;94
64
40;50
88;100
68
60
52
76
78
72
70
80
40;48
38,38A
40;46
34
P
58
74
36
42
40,40B;44
62
32

FIG. 3B

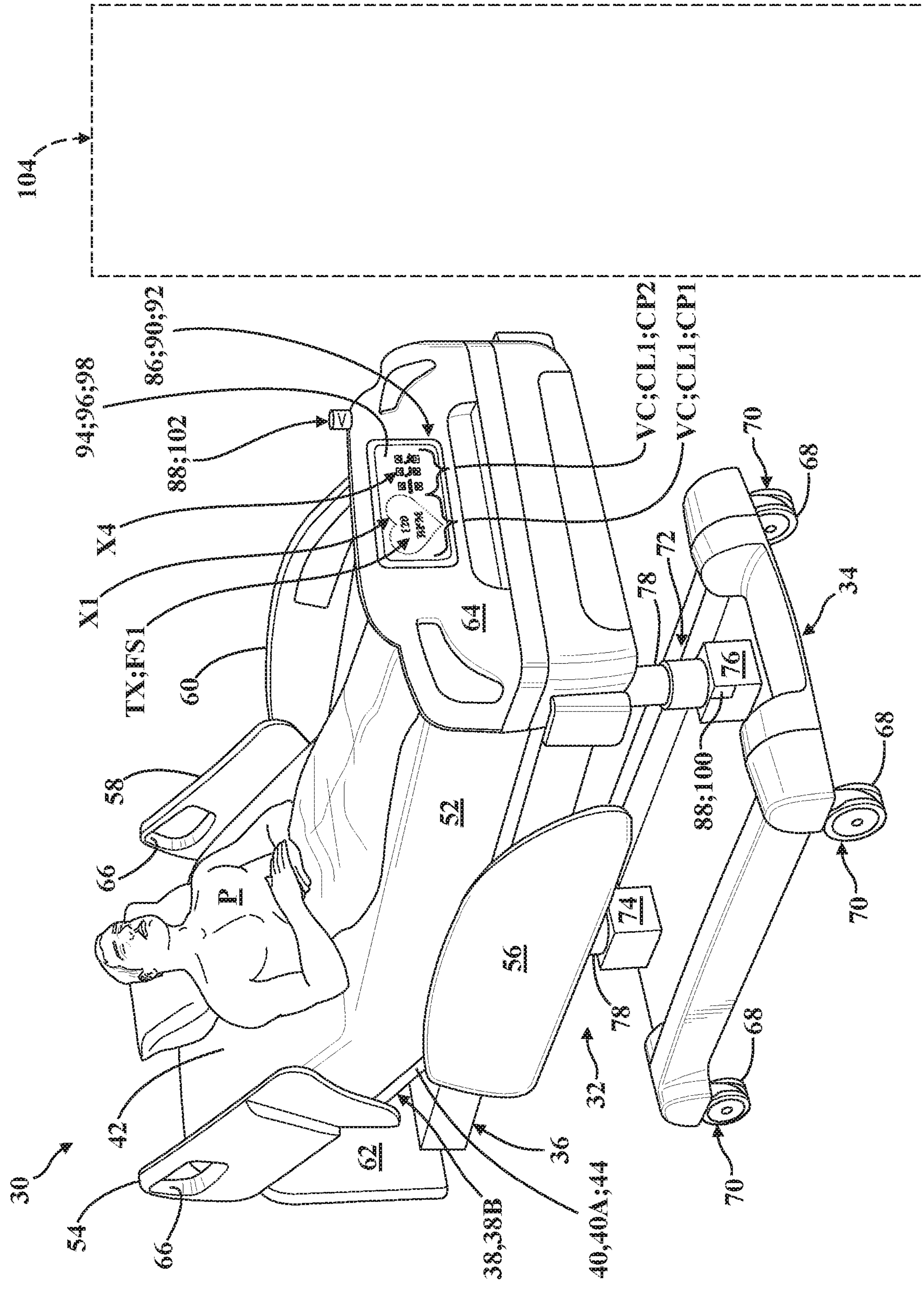

30
54
66
62
42
38,38B
40,40A;44
36
32
78
56
74
70
68
P
52
58
66
60
TX;FS1
X1
X4
88;102
94;96;98
86;90;92
IV
64
76
88;100
72
34
104
VC;CL1;CP2
VC;CL1;CP1

FIG. 4A

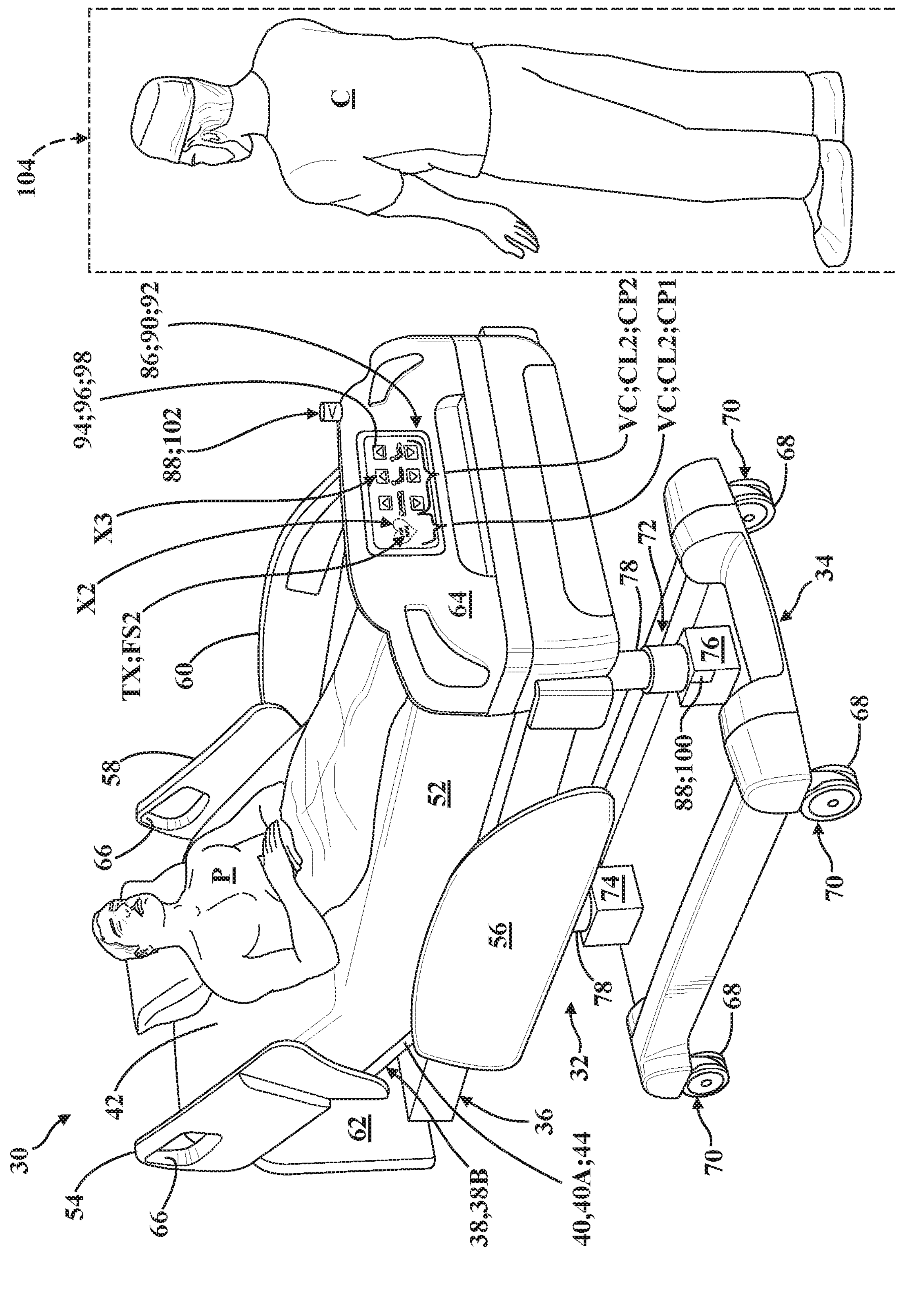

104
C
94;96;98
86;90;92
88;102
IV
VC;CL2;CP2
VC;CL2;CP1
X3
X2
TX;FS2
60
58
66
P
52
64
70
68
72
78
34
76
88;100
56
74
78
32
30
42
54
62
36
38,38B
40,40A;44

FIG. 4B

PATIENT SUPPORT APPARATUS USER INTERFACES

CROSS-REFERENCE TO RELATED APPLICATION

The subject patent application claims priority to and all the benefits of U.S. Provisional Patent Application No. 62/525,373 filed on Jun. 27, 2017, the disclosure of which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

The present disclosure relates, generally, to patient support apparatuses and, more specifically, to patient support apparatus user interfaces.

BACKGROUND

Patient support apparatuses, such as hospital beds, stretchers, cots, tables, wheelchairs, and chairs are used to help caregivers facilitate care of patients in a health care setting. Conventional patient support apparatuses generally comprise a base and a patient support surface upon which the patient is supported. Often, these patient support apparatuses have one or more powered devices with motors to perform one or more functions, such as lifting and lowering the patient support surface, articulating one or more deck sections, raising a patient from a slouched position, turning a patient, centering a patient, extending a length or width of the patient support apparatus, and the like. Furthermore, these patient support apparatuses typically employ one or more sensors arranged to detect patient movement, monitor patient vital signs, and the like.

When a caregiver wishes to perform an operational function, such as operating a powered device that adjusts the patient support surface relative to the base, the caregiver actuates an input device of a user interface, often in the form of a touchscreen or a button on a control panel. Here, the user interface may also employ a screen to display visual content to the caregiver, such as patient data and operating or status conditions of the patient support apparatus. The visual content may further comprise various graphical menus, buttons, indicators, and the like, which may be navigated via the input device. Certain operational functions or features of the patient support apparatus may also be accessible to and adjustable by the patient. Here, the user interface may allow the patient to adjust the patient support surface between various positions or configurations, view and navigate visual content displayed on a screen (for example, a television program), adjust audio output (for example, volume), and the like.

As the number and complexity of functions integrated into conventional patient support apparatuses has increased, the associated user interfaces have also become more complex and expensive to manufacture. While conventional patient support apparatuses have generally performed well for their intended purpose, there remains a need in the art for a patient support apparatus which overcomes the disadvantages in the prior art and which affords caregivers and patients with improved usability and functionality in a number of different operating conditions.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A is a perspective view of a patient support apparatus according to the present disclosure shown having a base, a patient support deck supporting a patient, a lift mechanism interposed between the base and the patient support deck supporting the patient support deck in a second vertical configuration relative to the base, and a user interface coupled to the patient support deck and arranged for use by a caregiver, the user interface shown having a screen displaying visual content in a second content layout.

FIG. **1**B is another perspective view of the patient support apparatus of FIG. **1**A, shown with the lift mechanism supporting the patient support deck in a first vertical configuration relative to the base, and shown with the screen of the caregiver-accessible user interface displaying visual content in a first content layout.

FIG. **2** is a partial schematic view of a control system of the patient support apparatus of FIGS. **1**A-**1**B, the control system shown comprising a controller disposed in communication with embodiments of user interfaces displaying different visual content, and disposed in communication with actuators and sensors, including a proximity sensor schematically depicted as operating to sense movement within an envelope adjacent to the proximity sensor.

FIG. **3**A is a right-side view of the patient support apparatus of FIGS. **1**A-**1**B, shown with the patient support deck having a deck section arranged in a first section position, and with a proximity sensor shown operating to sense movement within an envelope adjacent to the caregiver-accessible user interface.

FIG. **3**B is another right-side view of the patient support apparatus of FIG. **3**A, shown with the deck section arranged in a second section position, and shown with a caregiver positioned within the envelope sensed by the proximity sensor.

FIG. **4**A is a perspective view of another embodiment of a patient support apparatus according to the present disclosure, shown with a user interface coupled arranged for use by a caregiver and having a screen displaying visual content in a first content layout, and with a proximity sensor shown operating to sense movement within an envelope adjacent to the caregiver-accessible user interface.

FIG. **4**B is another perspective view of the patient support apparatus of FIG. **4**A, shown with the screen of the caregiver-accessible user interface displaying visual content in a second content layout, and shown with a caregiver positioned within the envelope sensed by the proximity sensor.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Referring to FIGS. **1**A-**4**B, a patient support apparatus **30** is shown for supporting a patient P in a health care setting. The patient support apparatus **30** illustrated throughout the drawings is realized as a hospital bed. In other embodiments, however, the patient support apparatus **30** may be a stretcher, a cot, a table, a wheelchair, a chair, or a similar apparatus utilized in the care of patients.

A support structure **32** provides support for the patient P. In the representative embodiment illustrated herein, the support structure **32** comprises a base **34**, an intermediate frame **36**, and a patient support deck **38**. The intermediate frame **36** and the patient support deck **38** are spaced above the base **34** in FIGS. **1**A-**1**B. As is described in greater detail below, the intermediate frame **36** and the patient support deck **38** are arranged for movement relative to the base **34** between a plurality of vertical configurations **38**A, **38**B (compare FIGS. **1**A-**1**B).

As is best depicted in FIGS. **3**A-**3**B, the patient support deck **38** has at least one deck section **40** arranged for movement relative to the intermediate frame **36** between a plurality of section positions **40**A, **40**B. The deck sections **40** of the patient support deck **38** provide a patient support surface **42** upon which the patient P is supported. More specifically, in the representative embodiments of the patient support apparatus **30** illustrated herein, the patient support deck **38** has four deck sections **40** which cooperate to define the patient support surface **42**: a back section **44**, a seat section **46**, a leg section **48**, and a foot section **50**. Here, the seat section **46** is fixed to the intermediate frame **36** and is not arranged for movement relative thereto. However, it will be appreciated that the seat section **46** could be movable relative to other deck sections **40** in some embodiments. However, it will be appreciated that the seat section **46** could be movable relative to other deck sections **40** in some embodiments. Conversely, the back section **44** and the leg section **48** are arranged for independent movement relative to each other and to the intermediate frame **36**, as described in greater detail below, and the foot section **50** is arranged to move partially concurrently with the leg section **48**. Other configurations and arrangements are contemplated.

A mattress **52** is disposed on the patient support deck **38** during use. The mattress **52** comprises a secondary patient support surface **42** upon which the patient P is supported. The base **34**, the intermediate frame **36**, and the patient support deck **38** each have a head end and a foot end corresponding to designated placement of the patient's P head and feet on the patient support apparatus **30**. It will be appreciated that the specific configuration of the support structure **32** may take on any known or conventional design, and is not limited to that specifically illustrated and described herein. In addition, the mattress **52** may be omitted in certain embodiments, such that the patient P can rest directly on the patient support surface **42** defined by the deck sections **40** of the patient support deck **38**.

Side rails **54**, **56**, **58**, **60** are coupled to the support structure **32** and are supported by the base **34**. A first side rail **54** is positioned at a right head end of the intermediate frame **36**. A second side rail **56** is positioned at a right foot end of the intermediate frame **36**. A third side rail **58** is positioned at a left head end of the intermediate frame **36**. A fourth side rail **60** is positioned at a left foot end of the intermediate frame **36**. The side rails **54**, **56**, **58**, **60** are advantageously movable between a raised position in which they block ingress and egress into and out of the patient support apparatus **30**, one or more intermediate positions, and a lowered position in which they are not an obstacle to such ingress and egress. It will be appreciated that there may be fewer side rails for certain embodiments, such as where the patient support apparatus **30** is realized as a stretcher or a cot. Moreover, it will be appreciated that in certain configurations the patient support apparatus **30** may not include any side rails. Similarly, it will be appreciated that side rails may be attached to any suitable component or structure of the patient support apparatus **30**. Furthermore, in certain embodiments the first and third side rails **54**, **58** are coupled to a deck section **40** for concurrent movement between section positions **40**A, **40**B (for example, see FIGS. **3**A-**3**B). In FIGS. **3**A-**3**B, which depict right-side views of the patient support apparatus **30**, the first and second side rails **54**, **56** are omitted for clarity.

As shown in FIGS. **1**A-**1**B, a headboard **62** and a footboard **64** are coupled to the intermediate frame **36** of the support structure **32**. However, it will be appreciated that the headboard **62** and/or footboard **64** may be coupled to other locations on the patient support apparatus **30**, such as the base **34**, or may be omitted in certain embodiments.

One or more caregiver interfaces **66**, such as handles, are shown in FIGS. **1**A-**1**B as being integrated into the first and third side rails **54**, **58** to facilitate movement of the patient support apparatus **30**. Additional caregiver interfaces **66** may be integrated into the headboard **62**, the footboard **64**, and/or other components of the patient support apparatus **30**, such as the second and/or fourth side rails **56**, **60**, the intermediate frame **36**, and the like. The caregiver interfaces **66** are shaped so as to be grasped by a caregiver as a way to position or otherwise manipulate the patient support apparatus **30** for movement. It will be appreciated that the caregiver interfaces **66** could be integrated with or operatively attached to any suitable portion of the patient support apparatus **30**, or may be omitted in certain embodiments.

Wheels **68** are coupled to the base **34** to facilitate transportation over floor surfaces. The wheels **68** are arranged in each of four quadrants of the base **34**, adjacent to corners of the base **34**. In the embodiments shown, the wheels **68** are caster wheels able to rotate and swivel relative to the support structure **32** during transport. Here, each of the wheels **68** forms part of a caster assembly **70** mounted to the base **34**. It should be understood that various configurations of the caster assemblies **70** are contemplated. In addition, in some embodiments, the wheels **68** may not be caster wheels. Moreover, it will be appreciated that the wheels **68** may be non-steerable, steerable, non-powered, powered, or combinations thereof. While the representative embodiment of the patient support apparatus **30** illustrated herein employs four wheels **68**, additional wheels are also contemplated. For example, the patient support apparatus **30** may comprise four non-powered, non-steerable wheels, along with one or more additional powered wheels. In some cases, the patient support apparatus **30** may not include any wheels. In other embodiments, one or more auxiliary wheels (powered or non-powered), which are movable between stowed positions and deployed positions, may be coupled to the support structure **32**. In some cases, when auxiliary wheels are located between caster assemblies **70** and contact the floor surface in the deployed position, they may cause two of the caster assemblies **70** to be lifted off the floor surface, thereby shortening a wheel base of the patient support apparatus **30**. A fifth wheel may also be arranged substantially in a center of the base **34**. Other configurations are contemplated.

The patient support apparatus **30** further comprises a lift mechanism, generally indicated at **72**, which operates to lift and lower the intermediate frame **36** relative to the base **34** which, in turn, moves the patient support deck **38** between a first vertical configuration **38**A (for example, a "lowered" vertical position as depicted in FIGS. **1**B and **3**A-**3**B), a second vertical configuration **38**B (for example, a "raised" vertical position as depicted in FIGS. **1**A and **4**A-**4**B), or to any desired vertical position in between. To this end, the illustrated lift mechanism **72** comprises a head end lift member **74** and a foot end lift member **76** which are each arranged to facilitate movement of the intermediate frame **36** with respect to the base **34** using one or more lift actuators **78** (see FIGS. **1**A and **2**-**4**B; not shown in detail). The lift actuators **78** may be realized as linear actuators, rotary actuators, or other types of actuators, and may be electrically operated and/or may be hydraulic. It is contemplated that, in some embodiments, only one lift member and one associated lift actuator may be employed, e.g., to raise only one end of the intermediate frame **36**, or one central lift actuator to raise and lower the intermediate frame **36**. The construction of the lift mechanism **72**, the head end lift member **74**, and/or the foot end lift member **76** may take on any known or conventional design, and is not limited to that specifically illustrated. By way of non-limiting example, the lift mechanism **72** could comprise a “scissor” linkage arranged between the base **34** and the intermediate frame **36** with one or more actuators configured to facilitate vertical movement of the patient support deck **38**.

As noted above, the patient support deck **38** is operatively attached to the intermediate frame **36**, and the deck section **40** is arranged for movement between a first section position **40**A (see FIG. **3**A) and a second section position **40**B (see FIG. **3**B). To this end, one or more deck actuators **80** are interposed between the deck section **40** and the intermediate frame **36** to move the deck section **40** between the first section position **40**A (see FIG. **3**A), the second section position **40**B (see FIG. **3**B), and any other suitable section position. In the representative embodiment illustrated herein, the deck actuator **80** is realized as a linear actuator disposed in force-translating relationship between the deck section **40** and the intermediate frame **36**. More specifically, one deck actuator **80** is provided between the intermediate frame **36** and the back section **44**, and another deck actuator **80** is provided between the intermediate frame **36** and the leg section **48**, and each of the deck actuators **80** is arranged for independent movement to position the respective deck sections **40** to adjust the shape of the patient support surface **42** between a plurality of patient support configurations (for example, a flat configuration, a raised fowler configuration, a seated configuration, etc.).

Those having ordinary skill in the art will appreciate that the patient support apparatus **30** could employ any suitable number of deck actuators **80**, of any suitable type or configuration sufficient to effect selective movement of the deck section **40** relative to the support structure **32**. By way of non-limiting example, the deck actuator **80** could be a linear actuator or one or more rotary actuators driven electronically and/or hydraulically, and/or controlled or driven in any suitable way. Moreover, the deck actuator **80** could be mounted, secured, coupled, or otherwise operatively attached to the intermediate frame **36** and to the deck section **40**, either directly or indirectly, in any suitable way. In addition, one or more of the deck actuators **80** could be omitted for certain applications.

Referring now to FIGS. **1**A-**2**, the patient support apparatus **30** employs a control system, generally indicated at **82**, to effect operation of various functions of the patient support apparatus **30**, as described in greater detail below. To this end, and as is best shown schematically in FIG. **2**, the control system **82** generally comprises a controller **84** disposed in communication with one or more user interfaces **86** adapted for use by the patient P and/or a caregiver C to facilitate operation of one or more functions of the patient support apparatus **30**. In certain embodiments, the controller **84** is also disposed in communication with the lift actuators **78**, the deck actuators **80**, and/or one or more sensors **88**. Each of these components will be described in greater detail below.

As noted above, the controller **84** is best depicted schematically FIG. **2**, and has been omitted from certain drawings for the purposes of clarity and consistency. It will be appreciated that the controller **84** and/or the control system **82** can be configured or otherwise arranged in a number of different ways. The controller **84** may have one or more microprocessors for processing instructions or for processing an algorithm stored in memory to control operation of the actuators **78**, **80**, generation or interpretation of an input signal IS, communication with the user interfaces **86**, and the like. Additionally or alternatively, the controller **84** may comprise one or more microcontrollers, field programmable gate arrays, systems on a chip, discrete circuitry, and/or other suitable hardware, software, or firmware that is capable of carrying out the various functions and operations described herein. The controller **84** may be carried on-board the patient support apparatus **30**, such as on the base **34**, or may be remotely located. The controller **84** may comprise one or more subcontrollers configured to control all of the actuators **78**, **80** and/or user interfaces **86** or one or more subcontrollers for each actuator **78**, **80** and/or user interface **86**. The controller **84** may communicate with the actuators **78**, **80** and/or the user interfaces **86** via wired or wireless connections.

In the representative embodiment illustrated in FIGS. **1**A-**1**B, the patient support apparatus **30** comprises one or more user interfaces **86** which may be accessible by the patient P, the caregiver C, or by both the caregiver C and the patient P. The user interface **86** of the patient support apparatus **30** generally comprises an input device **90** configured to generate an input signal IS in response to activation by a user which, in turn, is communicated to the controller **84**. The controller **84**, in turn, is responsive to the input signal IS and can control or otherwise carry out one or more functions of the patient support apparatus **30** in response to receiving the input signal IS. Put differently, the controller **84** is configured to perform a function of the patient support apparatus **30** in response to receiving the input signal IS from the input device **90**. By way of non-limiting example, the input device **90** could be realized as a “lift bed” button, activation of which causes the controller **84** to drive the lift actuators **78** to move the patient support deck **38** and the intermediate frame **36** from the first vertical configuration **38**A (see FIG. **1**B) vertically away from the base **34** towards the second vertical configuration **38**B (see FIG. **1**A). Moreover, in some embodiments, the controller **84** may be configured to facilitate navigation of visual content VC of the user interface **86** in response to receiving the input signal IS from the input device **90**. Thus, it will be appreciated that the user interface **86** could be configured in a number of different ways sufficient to generate the input signal IS. As such, it will be appreciated that the user interfaces **86** could be of a number of different styles, shapes, configurations, and the like.

In the representative embodiments illustrated herein, the user interface **86** is realized as a touchscreen **92** comprising a screen **94** and a touch sensor **96**. As is described in greater detail below, the screen **94** is configured to display visual content VC to the user, and may be of any suitable size, shape, and/or orientation sufficient to display visual content VC. By way of non-limiting example, the screen **94** could be realized as a curved LCD panel extending along the length or width of the patient support apparatus **30**. The touch sensor **96** is operatively attached to the screen **94**, and defines an input surface **98** arranged adjacent to the screen **94** that is adapted for interaction with the user (e.g., the caregiver C and/or the patient P). Thus, the screen **94** generally forms part of one or more of the user interfaces **86** for operating the patient support apparatus **30**, such as where activation or manipulation of the input device **90** (for example, a touch sensor **96** operatively attached to the screen **94**) generates the input signal IS used by the controller **84** to facilitate navigation and/or activation of the visual content VC (e.g., by navigating menus and/or actuating virtual buttons represented as visual content VC on the screen **94** by engaging the touch sensor **96**).

In the illustrated embodiment, the screen **94** is operatively attached to the patient support apparatus **30** for concurrent movement. More specifically, the screen **94** is coupled to the footboard **64** for concurrent movement with the patient support deck **38** between the vertical configurations **38**A, **38**B via the lift mechanism **72**, as noted above (compare FIGS. **1**A-**1**B). However, it will be appreciated that the screen **94** could be located remotely from the input device **90**. In some embodiments, the user interface **86** is configured to generate a haptic signal, such as vibration from a motor adjacent to the screen **94**, in response to activation of the input device **90**. Other arrangements and configurations are contemplated.

In some embodiments, the patient support apparatus **30** further comprises a lift sensor, generally indicated at **100**, to determine movement of the patient support deck **38** between the vertical configurations **38**A, **38**B via the lift mechanism **72** (compare FIGS. **1**A-**1**B). Here, the lift sensor **100** is disposed in communication with the controller **84** which, in turn, is configured to display visual content VC on the screen **94** in different ways based on the position of the patient support deck **38** relative to the base **34** determined (or "sensed") via the lift sensor **100**, as is described in greater detail below in connection with FIGS. **1**A-**2**.

Those having ordinary skill in the art will appreciate that the lift sensor **100** could be realized in a number of different ways. By way of non-limiting example, the lift sensor **100** could be realized as one or more discrete components, such as a linear potentiometer, a range sensor, a hall-effect sensor, a limit switch, an accelerometer, a gyroscope, and the like generally configured or arranged to measure position, height, and/or movement. Further, the lift sensor **100** could be an encoder, a current sensor, and the like coupled to or in communication with one of the lift actuators **78**. Moreover, the functionality afforded by the lift sensor **100** could be entirely or partially realized with software or code for certain applications. Other configurations are contemplated.

In some embodiments, the patient support apparatus **30** further comprises a proximity sensor, generally indicated at **102**, to determine movement occurring within an envelope **104** defined adjacent to a caregiver-accessible user interface **86** coupled to the footboard **64** of the patient support apparatus **30** (see FIGS. **2**-**4**B). Here, the proximity sensor **102** is disposed in communication with the controller **84** which, in turn, is configured to display visual content VC on the screen **94** in different ways based on the presence or absence of movement occurring within the envelope **104** determined (or "sensed") by the proximity sensor **102**, as is described in greater detail below in connection with FIGS. **2**-**4**B.

Those having ordinary skill in the art will appreciate that the proximity sensor **102** could be realized in a number of different ways. By way of non-limiting example, the proximity sensor **102** could be realized as one or more discrete components, such as a photoelectric emitter/sensor, a photodetector sensor, a laser rangefinder, a passive charge-coupled device (e.g., a digital camera), a passive thermal infrared sensor (e.g., a forward-looking infrared camera), a radar transmitter/sensor, a sonar transmitter/sensor, and the like generally configured or arranged to detect changes in heat, air pressure, and/or position and/or movement. The proximity sensor **102** could also be realized as a detector configured to respond to the presence or absence of a token, tracker, badge, portable electronic device, and the like carried by the caregiver (e.g., via radio-frequency identification, near-field communication, global positioning satellites, Bluetooth®, Wi-Fi™, and the like). Further, the proximity sensor **102** could be realized as a part of the touchscreen **92** in some embodiments, such as based on electrostatic fields generated with a capacitive-type touch sensor **96**. Here too, the functionality afforded by the proximity sensor **102** could be entirely or partially realized with software or code for certain applications. Other configurations are contemplated.

As noted above, in the representative embodiment illustrated in FIGS. **1**A-**2**, the screen **94** forms part of a caregiver-accessible user interface **86** which presents visual content VC to the caregiver C in different ways based on or otherwise corresponding to the arrangement of the patient support deck **38** relative to the base **34**. To this end, the controller **84** employs the lift sensor **100** to determine the relative position of the patient support deck **38** between the first and second vertical configurations **38**A, **38**B, displays visual content VC on the screen **94** in a first content layout CL**1** when the patient support deck **38** is in the first vertical configuration **38**A (see FIG. **1**B), and displays visual content VC on the screen **94** in a second content layout CL**2** when the patient support deck **38** is in the second vertical configuration **38**B (see FIG. **1**A). The visual content VC and first and second content layouts CL**1**, CL**2** will be described in greater detail below.

It will be appreciated that multiple lift sensors **100** could be employed by the controller **84** in certain embodiments, such as to facilitate differentiating the respective heights of the head-end and the foot-end of the patient support deck **38**. This differentiation may be used to adjust, optimize, or otherwise change how visual content VC is presented on the screen **94** in some embodiments. Here, it will be appreciated that the specific position and/or orientation of the screen **94** may change relative to the caregiver C based on how the patient support deck **38** is orientated because the screen **94** is coupled to the footboard **64** in the illustrated embodiment. Thus, in embodiments of the patient support apparatus **30** where the head end lift member **74** and the foot end lift member **76** can be driven or otherwise actuated independently (e.g., to place the patient support deck **38** in a Trendelenburg position), the controller **84** could be configured to display visual content VC in different ways based on the orientation and/or position of the screen **94** relative to the base **34** (e.g., using one or more accelerometers, gyroscopes, inertial sensors, and the like). To this end, and by way of non-limiting example, the controller **84** could accommodate changes in the orientation of the screen **94** by presenting, rendering, or otherwise displaying different types of visual content VC, by scaling visual content VC, and/or by otherwise modifying visual content VC as the lift members **74**, **76** move the patient support deck **38** to and between different configurations. Other embodiments are contemplated.

As will be appreciated from the subsequent description of the control system **82** in connection with FIG. **2** below, in some embodiments, the visual content VC represents a navigable graphical interface which serves as part of the user interface **86** employed to control the patient support apparatus **30**. Here, because the screen **94** moves currently with the patient support deck **38** between the vertical configuration **38**A, **38**B as noted above, the screen **94** is necessarily further away from the caregiver's C eyes in the first vertical configuration **38**A (see FIG. **1**B) than in the second vertical configuration **38**B (see FIG. **1**A). Thus, the visual content VC displayed by the screen **94** in the first content layout CL1 may be scaled, arranged, or otherwise configured differently from the second content layout CL**2** in some embodiments so as to improve visibility and functionality when the screen **94** is positioned further away from the caregiver C.

With continued reference to the embodiment illustrated in FIGS. **1**A-**1**B, the visual content VC comprises a first content portion CP**1**, the first content layout CL**1** comprises a first scaling factor X1 which is associated with the first content portion CP1, and the second content layout CL2 comprises a second scaling factor X2 which is likewise associated with the first content portion CP1. Here, the first scaling factor X1 is greater than the second scaling factor X2 such that at least the first content portion CP1 of the visual content VC displayed by the screen **94** is "larger" when the patient support deck **38** is in the first vertical configuration **38**A (see FIG. **1**B) compared to when the patient support deck **38** is in the second vertical configuration **38**B (see FIG. **1**A). In some embodiments, the visual content VC further comprises a second content portion CP2 (see FIGS. **2** and **4**A-**4**B) which is distinguishable from the first content portion CP1.

Those having ordinary skill in the art will appreciate that the visual content VC can be delineated in a number of different ways, and may comprise any suitable number of content portions CP1, CP2 which may be distinguishable from each other (e.g., discrete icons, menus, graphics, symbols, buttons, and the like). Thus, in some embodiments, discrete portions of the same content portion may change in different ways. By way of non-limiting example, and as is described in greater detail below in connection with the embodiment depicted in FIGS. **4**A-**4**B, the first content portion CP1 may comprises graphics which change between the first and second content layouts CL1, Cl2 based on the first and second scaling factors X1, X2, and the first content portion CP1 may also comprise text TX which changes between first and second font sizes FS1, FS2. Thus, it will be appreciated that sub-portions of one content portion may change relative to each other (e.g., the graphics and text TX of the first content portion CP1) and/or relative to a different content portion (e.g., CP2) as the screen **94** displays different content layouts CL1, CL2.

As will be appreciated from the subsequent description below, the first and/or the second content layouts CL1, CL2 can be configured in a number of different ways so as to optimize the functionality and visibility of the visual content VC based on changes between the vertical configurations **38**A, **38**B (and/or based on other parameters associated with utilization of the patient support apparatus **30** as described in greater detail below). By way of non-limiting example, the second content layout CL2 shown in FIG. **1**A includes a total of six virtual "buttons" which may be used to control three exemplary features of the patient support apparatus **30**, while the first content layout CL1 shown in FIG. **1**B includes two larger virtual "buttons" for controlling one of these three exemplary features of the patient support apparatus **30**. In this representative embodiment, these two "buttons" are associated with the first content portion CP1 and are provided for lifting and/or lowering the patient support deck **38**. Here, it will be appreciated that by increasing the size of the first content portion CP1 when the patient support deck **38** is positioned closer to the base **34** the caregiver C is presented with larger virtual "buttons" which afford improved visibility and ease of engagement under certain operating conditions of the patient support apparatus (e.g., when the screen **94** of the user interface **86** is closer to the floor).

Furthermore, it will be appreciated that the visual content VC could dynamically change between the content layouts CL1, CL2 as the patient support deck **38** moves between the vertical configurations **38**A, **38**B. By way of non-limiting example, the controller **84** could linearly scale the first content portion CP1 of the visual content VC, such as by using the scaling factors X1, X2 as respective end-points between the vertical configurations **38**A, **38**B, to display visual content VC at an intermediate content layout CL1.5 with an intermediate scaling factor X1.5 when the patient support deck **38** is between the first and second vertical configurations **38**A, **38**B (not shown). In addition, it will be appreciated that the controller **84** can display visual content VC in different ways, based such as on which direction the patient support deck **38** is moving. By way of non-limiting example, when the patient support deck **38** is moved towards the floor as the caregiver C actuates a "lower bed" button, the content layout could dynamically change to increase the size of the "lower bed" button as the patient support deck **38** moves closer to the floor. In some embodiments, one or more content portions CP1, CP2 of the visual content VC may change concurrently or separately in ways other than by resizing graphics and text TX based on the scaling factors X1, X2. By way of non-limiting example, as the "lower bed" button associated with the first content portion CP1 is scaled up in size in response to movement toward the first vertical configuration **38**A, other buttons, controls, or information (e.g., associated with the second content portion CP2 or another content portion) could be hidden, moved off-screen, and the like. In some embodiments, once the patient support deck **38** has been positioned as close to the floor as possible in the first vertical configuration **38**A, the controller **84** could hide everything associated with the first content portion CP1 except for a large "bed up" button used to subsequently move the patient support deck **38** away from the floor. Here in this embodiment, after the "bed up" button has actuated by the caregiver C, the "bed up" button could remain unchanged in size until released, and then the controller **84** could subsequently display different visual content VC (e.g., the first content portion CP1 depicted in FIG. **1**A) based on the current position of the patient support deck **38**. Other embodiments and configurations are contemplated.

Referring now to FIGS. **2**-**4**B, as noted above, the illustrated embodiment of the patient support apparatus **30** employs the controller **84** to adjust visual content VC displayed on the screen **94** based on movement within the envelope determined via the proximity sensor **102**. To this end, the controller **84** is configured to display visual content VC in the first content layout CL1 during an absence of movement occurring within the envelope **104** sensed by the proximity sensor **102** (see FIGS. **2**, **3**A, and **4**A), and to display visual content VC in the second content layout CL2 in response to movement occurring within the envelope **104** sensed by the proximity sensor **102**. Here, one or more of the first content portion CP1, the second content portion CP2, other content portions, or sub-portions of content portions of the visual content VC may change in various ways depending on how the patient support apparatus **30** utilizes the proximity sensor **102**.

In the representative embodiment depicted in FIGS. **4**A-**4**B (see also FIG. **2**), the proximity sensor **102** is coupled to the footboard **64** adjacent to and spaced from the screen **94** of the caregiver-accessible user interface **86**. As is depicted in FIGS. **3**A-**4**B, this arrangement positions the envelope **104** adjacent to the foot-end of the patient support apparatus **30** such that when movement is sensed by the proximity sensor nearby the foot-end of the patient support apparatus **30**, the controller **84** adjusts, alters, or otherwise changes the visual content VC displayed on the screen **94** from the first content layout CL1 (see FIG. **4**A) to the second content layout CL2 (see FIG. **4**B). Put differently, the arrangement of the proximity sensor **102** described above allows the caregiver C to view visual content VC in different ways based on their distance from (or proximity to) the patient support apparatus.

Those having ordinary skill in the art will appreciate that this configuration affords the caregiver C with the ability to view visual content VC from a distance and without necessarily approaching the patient support apparatus **30**. This can be advantageous in situations where the caregiver C wants to observe certain types of relevant visual content VC displayed on the screen **94** without disturbing the patient P, such as when the patient P is resting or asleep. In addition, it will be appreciated that this configuration also affords the caregiver C with the ability to automatically transition to visual content VC which is more relevant when viewed closer to the screen **94**.

By way of non-limiting example, in the representative embodiment illustrated in FIGS. **4**A-**4**B (see also FIG. **2**), the visual content VC comprises first and second content portions CP**1**, CP**2** which are similar to but different from the embodiment described above in connection with FIGS. **1**A-**1**B. In this embodiment, the second content portion CP**2** comprises the six virtual "buttons" described above, and the first content portion CP**1** comprises a graphical representation of a heart in which text TX, representing the patient's P current heartrate, is displayed (determined such as with a patient monitoring system, one or more patient sensors, and the like).

As shown in FIGS. **2** and **4**A-**4**B, both the text TX and the graphical representation of the heart, which together comprise the first content portion CP**1** in this embodiment, are associated with and sized according to the first scaling factor X**1** when the controller **84** displays the first content layout CL**1** on the screen **94** (see FIG. **4**A), and are associated with and sized according to the second scaling factor X**2** when the controller **84** displays the second content layout CL**2** on the screen **94** (see FIG. **4**B). Here too, the first scaling factor X**1** is greater than the second scaling factor X**2** (compare FIGS. **4**A-**4**B; see also FIG. **2**). Furthermore, as noted above, sub-portions of the same content portion of the visual content VC can be displayed on the screen **94** in different ways relative to, or independent of, one another in certain embodiments. Here and to this end, the text TX of the first content portion CP**1** (which represents the patient's current heartrate in this embodiment) comprises a first font size FS**1** (see FIGS. **2** and **4**A) associated with the first scaling factor X**1**, and a second font size FS**2** (see FIGS. **2** and **4**B) associated with the second scaling factor X**2**. In this embodiment, the font sizes FS**1**, FS**2** correlate directly with (and proportional to) the scaling factors X**1**, X**2** such that the first font size FS**1** is larger than the second font size FS**2**. However, other configurations and relationships are contemplated (e.g., non-proportional relationships and/or inverse relationships such as those that would decrease the font size as the scaling factor increases). Thus, in this embodiment, each of the sub-portions of the first content portion CP**1** are sized larger in the first content layout CL**1** than they are sized in the second content layout CL**2** (compare FIGS. **4**A-**4**B; see also FIG. **2**).

With continued reference to FIGS. **2** and **4**A-**4**B, in this embodiment, the second content portion CP**2** comprising the six virtual "buttons" described above is associated with and sized according to a third scaling factor X**3** when the controller **84** displays the second content layout CL**2** on the screen **94** (see FIG. **4**B), and is associated with and sized according to a fourth scaling factor X**4** when the controller **84** displays the first content layout CL**1** on the screen **94** (see FIG. **4**A). Here, the third scaling factor X**3** is greater than the fourth scaling factor X**4** (compare FIGS. **4**A-**4**B; see also FIG. **2**). Thus, in this embodiment, each of the sub-portions of the second content portion CP**2** are sized smaller in the first content layout CL**1** than they are sized in the second content layout CL**2** (compare FIGS. **4**A-**4**B; see also FIG. **2**).

As noted above, when visual content VC is displayed in the first content layout CL**1**, the sub-portions of the first content portion CP**1** are scaled larger than they are scaled when in the second content layout CL**2**, whereas the sub-portions of the second content portion CP**2** are scaled smaller (see FIGS. **2** and **4**A). Conversely, when visual content VC is displayed in the second content layout CL**2**, the sub-portions of the first content portion CP**1** are scaled smaller than they are scaled when in the first content layout CL**1**, whereas the sub-portions of the second content portion CP**2** are scaled larger (see FIGS. **2** and **4**B).

Because the controller **84** is configured to display visual content VC on the screen **94** in the first content layout CL**1** during an absence of movement occurring within the envelope **104** in this embodiment, the caregiver C is able to observe visual content VC on the screen **94** which reflects the patient's P heartrate in a larger size than virtual "buttons" of the user interface **86** while they are positioned away from the patient support apparatus **30**. This allows the caregiver C to view the patient's P heartrate from a distance and without necessarily requiring that the caregiver C come into close proximity with the patient support apparatus **30** (e.g., with a quick glance into the patient's P room while making rounds so as not to disturb to the patient P). Moreover, while it is contemplated that the second content portion CP**2** of the visual content VC could be displayed or otherwise adjusted in ways other than by scaling as noted above (e.g., by hiding one or more sub-portions of the second content portion CP**2**), it may be advantageous in certain applications for one or more virtual "buttons" to remain displayed on the screen **94** in a smaller size alongside the larger heartrate text TX. Here, the continued presence of the second content portion CP**2** in the first content layout CL**1**, even with a smaller size when viewed from a distance, may communicate useful status information about the patient support apparatus **30**. By way of example, status information communicated by the smaller sized second content portion CP**2** could assure the caregiver that certain features of the patient support apparatus **30** remained "locked," that one or more of the deck sections **40** haven't been adjusted recently, that the patient P hasn't attempted to exit the patient support apparatus **30** without assistance, and the like. Other configurations are contemplated.

Furthermore, because the controller **84** is configured to display visual content VC on the screen **94** in the second content layout CL**2** in response to movement occurring within the envelope **104** in this embodiment, the caregiver C is able to observe visual content VC on the screen **94** which reflects the patient's P heartrate in a smaller size than virtual "buttons" of the user interface **86** while they are positioned nearby the patient support apparatus **30**. This allows the caregiver C to continue viewing the patient's P heartrate on the screen **94** in a smaller size as they approach the patient support apparatus **30**, while simultaneously improving their ability to view the virtual "buttons" of the user interface **86** by scaling the second content portion CP**2** to a larger size. Put differently, because the embodiments of the present disclosure allow visual content VC to be presented to the caregiver C in different ways based on their proximity to the patient P and/or to the patient support apparatus **30**, visual content VC which is relevant when the caregiver C is standing next to the patient support apparatus **30** (e.g., virtual "buttons" of the user interface **86** that raise or lower the patient support deck **38**) can automatically be presented on the screen **94** more prominently than when they the caregiver C is further away from the patient support apparatus **30**, where different visual content VC be more relevant to the caregiver C (e.g., large text TX representing the patient's P current heartrate).

Like the embodiment described above in connection with FIGS. **1**A-**2**, changes in the visual content VC may occur in a number of different ways, including where changing between the first and second content layouts CL**1**, CL**2** occurs in "steps" (e.g., with or without an intermediate content layout CL**1.5**), or where changing between the first and second content layouts CL**1**, CL**2** occurs progressively and/or dynamically. Furthermore, it will be appreciated that the examples described above represent illustrative examples of certain implementations of the embodiments of the present disclosure which have been described separately herein for the purposes of clarity and consistency. Other configurations are contemplated herein, including without limitation utilizing the controller **84** to adjust, change, or otherwise present visual content VC displayed in the screen **94** in different ways to differentiate between correspondingly different modes, states, conditions, and/or use of the patient support apparatus **30**, with or without the use of additional (and/or different types of) sensors **88**.

In this way, the embodiments of the present disclosure afford significant opportunities for enhancing the functionality and operation of user interfaces **86** employed by patient support apparatuses **30**. Specifically, visual content VC can be displayed and viewed in a number of different ways which contribute to improved usability of the patient support apparatus **30** without necessitating the use of overtly expensive hardware. Moreover, visual content can be displayed and in ways that provide caregivers C with convenient, easy-to-use, and intuitive features. Thus, the patient support apparatus **30** can be manufactured in a cost-effective manner while, at the same time, affording opportunities for improved functionality, features, and usability.

As noted above, the subject patent application is related to U.S. Provisional Patent Application No. 62/525,373 filed on Jun. 27, 2017. In addition, the subject patent application is also related to: U.S. Provisional Patent Application No. 62/525,353 filed on Jun. 27, 2017 and its corresponding Non-Provisional patent application Ser. No. 16/020,068 filed on Jun. 27, 2018; U.S. Provisional Patent Application No. 62/525,359 filed on Jun. 27, 2017 and its corresponding Non-Provisional patent application Ser. No. 16/020,052 filed on Jun. 27, 2018; U.S. Provisional Patent Application No. 62/525,363 filed on Jun. 27, 2017 and its corresponding Non-Provisional patent application Ser. No. 16/020,085 filed on Jun. 27, 2018; U.S. Provisional Patent Application No. 62/525,368 filed on Jun. 27, 2017 and its corresponding Non-Provisional patent application Ser. No. 16/019,973 filed on Jun. 27, 2018; and U.S. Provisional Patent Application No. 62/525,377 filed on Jun. 27, 2017 and its corresponding Non-Provisional patent application Ser. No. 16/019,986 filed on Jun. 27, 2018. The disclosures of each of the above-identified Provisional Patent Applications and corresponding Non-Provisional Patent Applications are each hereby incorporated by reference in their entirety.

It will be further appreciated that the terms "include," "includes," and "including" have the same meaning as the terms "comprise," "comprises," and "comprising." Moreover, it will be appreciated that terms such as "first," "second," "third," and the like are used herein to differentiate certain structural features and components for the non-limiting, illustrative purposes of clarity and consistency.

Several configurations have been discussed in the foregoing description. However, the configurations discussed herein are not intended to be exhaustive or limit the invention to any particular form. The terminology which has been used is intended to be in the nature of words of description rather than of limitation. Many modifications and variations are possible in light of the above teachings and the invention may be practiced otherwise than as specifically described.

The invention is intended to be defined in the independent claims, with specific features laid out in the dependent claims, wherein the subject-matter of a claim dependent from one independent claim can also be implemented in connection with another independent claim.

What is claimed is:

1. A patient support apparatus comprising:

a base;

a patient support deck operatively attached to said base and arranged for movement relative to said base;

a lift mechanism interposed between said base and said patient support deck to move said patient support deck between a first vertical configuration and a second vertical configuration relative to said base, wherein said patient support deck is closer to said base in said first vertical configuration than in said second vertical configuration;

a user interface configured to operate said patient support apparatus, said user interface comprising a screen configured to display visual content in a first content layout and in a second content layout, said visual content comprising a first content portion, with said screen coupled to said patient support deck for concurrent movement between said vertical configurations; and

a controller in communication with said screen and said lift mechanism, said controller configured to display said visual content in said first content layout when said patient support deck is in said first vertical configuration, said first content layout having a first scaling factor associated with said first content portion, and further configured to display said visual content in said second content layout when said patient support deck is in said second vertical configuration, said second content layout having a second scaling factor associated with said first content portion, with said first scaling factor being greater than said second scaling factor to optimize visibility of said first content portion based on changes between said first vertical configuration and said second vertical configuration.

2. The patient support apparatus as set forth in claim **1**, further comprising an input device in communication with said controller and configured to generate an input signal, said controller being configured to facilitate navigation of said visual content in response to receiving said input signal from said input device.

3. The patient support apparatus as set forth in claim **2**, wherein said input device is operatively attached to said screen.

4. The patient support apparatus as set forth in claim **3**, wherein said user interface and said input device comprise a touchscreen to display said visual content and to facilitate navigation of said visual content.

5. The patient support apparatus as set forth in claim **1**, further comprising a lift sensor to determine movement of said patient support deck between said first vertical configuration and said second vertical configuration.

6. The patient support apparatus as set forth in claim **5**, wherein said controller is in communication with said lift sensor and is configured to display said visual content in said first content layout when said lift sensor determines said patient support deck is in said first vertical configuration, and further configured to display said visual content in said second content layout when said lift sensor determines said patient support deck is in said second vertical configuration.

* * * * *